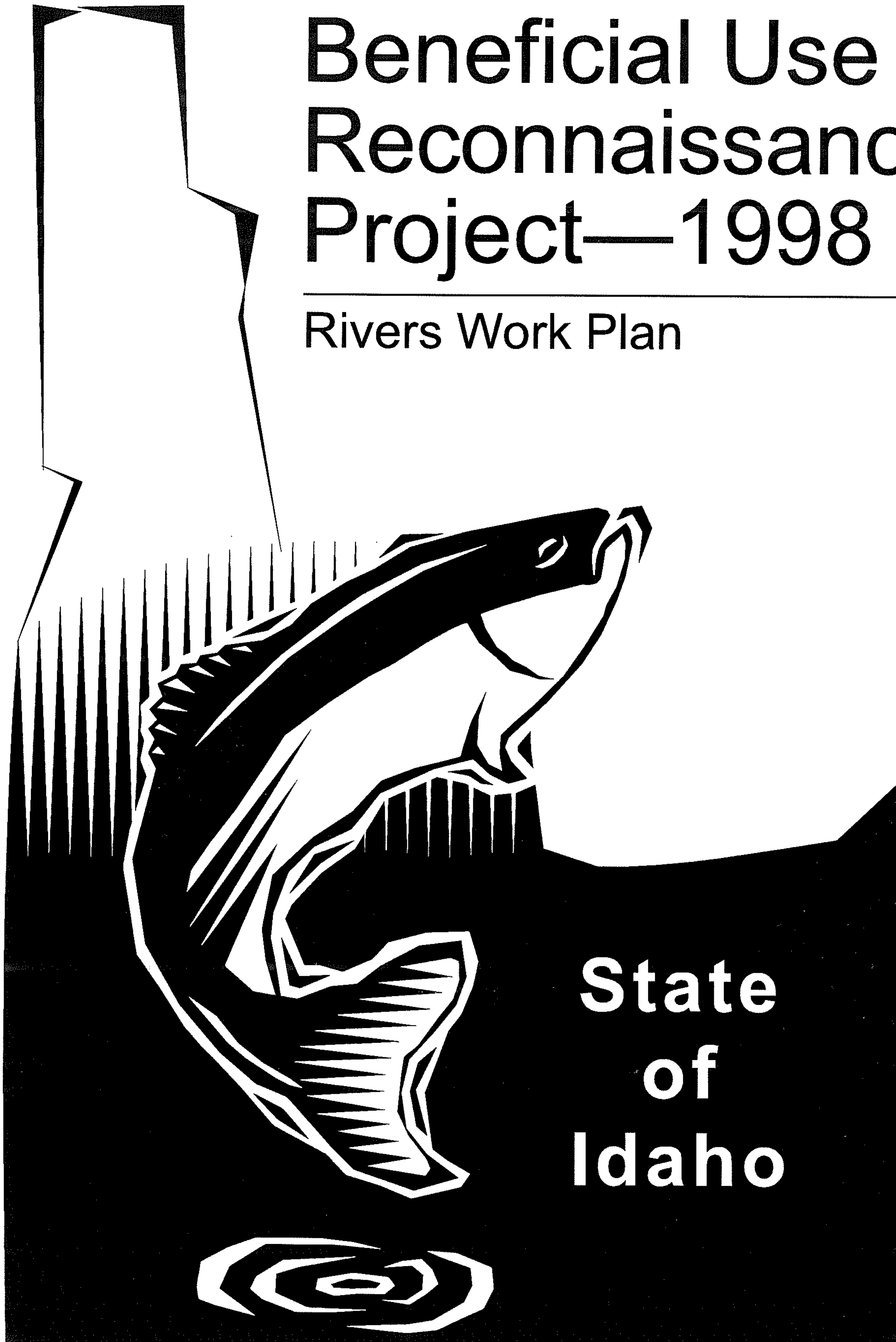
Beneficial Use Reconnaissance Project—1998

Rivers Work Plan



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River Work Plan

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Prepared for
Idaho Division of Environmental Quality
by
Beneficial Use Reconnaissance Project Technical Advisory Committee

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I. Introduction

In 1993, the Division of Environmental Quality (DEQ) embarked on a pilot program aimed at integrating biological and chemical monitoring with physical habitat assessment as a way of characterizing stream integrity and water quality (McIntyre 1993a). This program, the Beneficial Use Reconnaissance Project (BURP), was also developed as a response to Clean Water Act requirements to monitor and assess biology as well as to develop biocriteria.

The BURP work plan incorporated two new sections in 1997: one for rivers, and a second for lakes and reservoirs. For rivers, DEQ relied heavily on protocols developed by Idaho State University (ISU) and the U.S. Geological Survey (USGS). The following river work plan is a compilation of modified ISU and USGS National Water Quality Assessment protocols. The DEQ River Technical Advisory Committee (RTAC), which included representatives from DEQ central office and regional office technical staff, reviewed and modified the protocols to provide reconnaissance methods appropriate for rivers. The methods will be revised as necessary to ensure BURP goals and objectives are achieved.

The work plan describes the methods used by DEQ to measure water quality, beneficial-use status, and general water-body health. The protocols described in the work plan are meant to prescribe a reconnaissance level screen of water conditions. The RTAC considered time constraints, staff limitations, and costs in developing the work plan and selecting the protocols to be used.

II. Purpose

The purpose of the 1998 BURP river work plan is to provide statewide consistency in monitoring and data collection. This document describes how to conduct the BURP process by presenting the assumptions, methods, data handling, and equipment required.

This document does not describe the analysis and interpretation of the data collected. Interpretation of BURP data and any other relevant water-quality information is described in DEQ's *Water Body Assessment Guidance* (WBAG) document (DEQ 1996a). The WBAG document outlines the process DEQ uses in determining: 1) existing beneficial uses, and 2) beneficial-use support status (full support, not full support).

III. Objectives

The primary objectives of the 1998 BURP are to:

1. document the existing beneficial uses of water bodies to the extent possible at a reconnaissance level-intensity; and

2. collect data to assist determination of beneficial-use support statuses.

IV. Scope

As indicated by the name of the project, BURP is a reconnaissance level monitoring effort. There are limits on how much interpretation can be done with the type of data collected through this process. BURP is intended to merely differentiate between impaired and non-impaired water bodies. It is not intended to identify pollutants or their sources. It may be possible, however, to suggest causative agents of pollution through a synthesis of all existing data. Refinement of causative agents, quantification of their effects, and likely sources of pollution will be dependent on future monitoring above and beyond the scope of this project.

V. Rationale for Selected Parameters

Monitoring parameters and methods were selected by the Technical Advisory Committee and based on BURP objectives and relevant studies. Since the BURP objectives relate to beneficial uses, such as salmonid spawning, cold water biota, and primary and secondary contact recreation, many parameters relate directly to those uses. Where beneficial-use support statuses could not be evaluated directly, a surrogate measure was selected.

Physical/Chemical Parameters

Water Clarity

Water clarity has been correlated to chlorophyll *a* (Carlson 1977; Mills and Schiavore, Jr. 1982) and is influenced by other factors such as turbidity and dissolved organic color. Chambers and Kalff (1985) reported the depth of light transmittance relates to maximum macrophyte depth. Mossier (1993) concurred that the two were highly, positively correlated.

Temperature

Water temperature is an easily-measured physical parameter which has considerable biological and chemical significance. Fish and essentially all other aquatic plant and animal processes are temperature-dependent. Increased water temperatures are known to increase biological activity, and temperature can reach lethal limits for fishes (Smith 1982). The concentration of dissolved oxygen is inversely proportional to water temperature (Wetzel 1983).

Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life and is an important indicator of water-body health. Much information can be obtained from this single measure. Concentrations of dissolved oxygen in the water column determines which aquatic organisms will be able to exist there. It is related to the photosynthetic activities of algae and macrophytes as well as to the decomposition of organic material. Dissolved oxygen gradients can supply insight into the mixing patterns of a water body and the extent of dissolved-oxygen deficits. Anoxic conditions can influence other chemical properties of water through the oxygen-reduction potential (Wetzel 1983).

Hydrogen Ion Concentration (pH)

Hydrogen ion concentration, or pH, as with temperature, is an important regulator of many biological and chemical processes. The composition of aquatic communities is strongly influenced by pH (Marcus et al. 1986). The uptake and release rates of ions across gills, the primary method of ion regulation for aquatic animals, is at least partly pH-dependent (Smith 1982). Similarly, the toxicity of some chemicals is pH-dependent (Wetzel 1983).

Conductivity

Conductivity, or specific conductance, refers to the ability of water to conduct an electrical current. It is an indication of the concentration of dissolved solids. Kunkle et al. (1987) found conductivity to be an useful indicator of mining and agricultural effects. Royer and Minshall (1996) found sites designated as degraded generally had higher conductivities. Maret et al. (1997) reported conductivity was one environmental factor determining the distribution of fishes.

Discharge

Minshall (1993) noted that discharge is one of the principal abiotic factors shaping stream ecosystems. Nelson et al. (1992) found discharge regimes to be one of the attributes helpful in distinguishing different geologic regions. Discharge is one of a series of measurements taken by both Oregon and Washington in very similar bioassessment projects (Mulvey et al. 1992; Plotnikoff 1992). Discharge patterns affect habitat characteristics such as erosion, distribution of aquatic assemblages, and movement of suspended materials (Rankin 1995). Discharge and other associated parameters, such as gradient, may provide useful forms of discrimination between water bodies (Rankin 1995). Idaho State University used base flow to differentiate among intermediate- and large-size rivers (Royer and Minshall 1997). Discharge information, particularly annual discharge data, may provide an understanding of natural flow patterns and possible impacts to biological communities.

Width and Depth

Width and depth measurements, along with discharge data, provide meaningful information about river size and habitat characteristics. These variables have significant impact on the distribution of the aquatic community. Grouping rivers by width and depth may also be useful for purposes of data comparison (DEQ 1996 b).

Substrate

Sediment and its accumulation is detrimental to salmonid spawning (a beneficial use) since it limits the quality and quantity of the inter-gravel spaces, which are critical for egg incubation (Maret et al. 1993; Young et al. 1991; Scrivener and Brownlee 1989). Fine sediment and availability of living space have direct effects on both fish and insects (Marcus et al. 1990; Minshall 1984). Several studies and state projects have found relative substrate size to be an important indicator of water-quality effects due to activities in the watershed (Overton et al. 1993; McIntyre 1993b; Skille 1991).

Channel Alterations

The natural channel morphology and any channel modifications greatly affect in-stream conditions. Natural channel morphology varies according to area geomorphology, with high-gradient streams often flowing "straight" and low-gradient streams often meandering through floodplains. Channel alterations may include artificial bank stabilization or structures such as artificial embankments and riprap. Other frequently-used modifications include channelization, dams, and bridges (EPA 1996 a). Such water-management features often destabilize stream banks and increase flow velocities, leading to a greater potential for erosion and sedimentation. The reduction of meanders also changes habitat structural diversity (i.e., pools and riffles). Consequently, fish spawning and macroinvertebrate production are greatly influenced by such activities (Gordon et al. 1992). Land use is closely associated with channel alterations since large rivers often are modified for purposes of flood control, agricultural water supply, and electrical power supply (Rankin 1995).

Floodplain Disturbance

As wadable streams become large rivers, the relationship between the water course and its riparian area changes as well. For large rivers, the effect of shading by riparian vegetation is no longer of great importance. The size of the riparian area, however, becomes ecologically significant. The riparian, or floodplain, area serves as a natural filter, water storage facility, and biological breeding area. During the flood stage, when the river leaves its banks and flows out across the floodplain, sediment loads drop and water infiltrates the soils to be released to the river more slowly. At this point, many back-water ponds and wetlands are formed or filled, providing important breeding and rearing grounds. In order to measure this important aspect of rivers, ecologists have identified floodplain width as an indicator of floodplain function and health (Forman and Godron 1986).

Floodplain width has limited usefulness as an ecological indicator since river floodplain widths vary naturally due to geomorphological differences. Also, measuring floodplain width at a single spot does not provide information about the whole river. Thus, floodplain disturbance is used to assess a much larger area of the river.

Bank Stability

Removal of streambank vegetation and soil reduces the structural stability of the stream channel and negatively affects fish productivity (Platts 1990; Platts and Nelson 1989). Banks stabilized by deeply-rooted vegetation, rocks, logs, or other resistant materials are less susceptible to flow-related erosion, reduce water velocity along the stream perimeter, and aid in beneficial sedimentation (Bauer and Burton 1993).

Riparian Vegetation

The presence and condition of the riparian vegetation is important to the overall ecological health of the river and its floodplain. Healthy stands of riparian vegetation provide habitat for aquatic and terrestrial animals as well as perform important physical functions (e.g. erosion control, sediment catchment). Stands of naturally-occurring riparian vegetation can vary from river to river, depending on climate and geomorphology. Idaho rivers with broad floodplains will typically have large, continuous stands of cottonwoods. Others may have shrubs (willows, river birch) or more grass-like meadows.

Photo Documentation and Diagrammatic Mapping

Photographic records provide visual details concerning riparian conditions and river geomorphology. Diagrammatic mapping results in a representative map of the sampling reach. The map provides visual information and an approximate scale of important stream characteristics such as land use, geomorphic channel units, habitat features, and bank conditions (Meador et al. 1993). Such visual details complement field notes and habitat measurements. This type of documentation may also provide baseline information concerning qualitative changes in riparian conditions, land use, and river-channel modifications.

Biological Parameters

Macroinvertebrates

Macroinvertebrates are an essential part of the BURP process. This biological assemblage reflects a stream's overall ecological integrity. Because most streams are monitored infrequently, chemical monitoring is rarely representative of the long-term condition of the stream. Biological monitoring provides an wholistic representation of water conditions; it provides better classification of the stream's support status because the biological community is exposed to the stream's conditions over a long period of time. Macroinvertebrates are useful assessment tools because they are ubiquitous, include numerous species, and respond to physical and chemical impacts in the water column (Rosenberg and Resh 1993). Additionally, macroinvertebrates with certain environmental tolerances may provide some insight to pollutants (Johnson et al. 1993).

Fish

Fish contribute significantly to the ecology of the aquatic community. This biological assemblage is highly visible to the public and is an important economic resource in Idaho. Additionally, fish have relatively long life spans which can reflect long-term and current water-quality conditions. Due to their mobility, fish also have extensive ranges and may be useful for evaluating regional and large-habitat differences (Simon and Lyons 1995).

Periphyton

Periphyton (algae) is a useful indicator because of its wide distribution, numerous species, and rapid response to disturbance (EPA 1996b). Since periphyton exists in the water column, it is affected by both physical and chemical factors. Diatoms, a type of periphyton, have frequently been identified as useful biological indicators, particularly in Montana, Kentucky, Oklahoma, and European countries (Round 1991; Rosen 1995). Periphyton supplements fish and macroinvertebrate information due to its different trophic levels, motility, and life history (Allen 1995). Periphyton information, along with information on macroinvertebrates, may also serve as a back-up source of biological data if current fish information is unavailable for a particular river.

Aquatic Macrophyte Cover

Aquatic macrophytes affect water quality through species presence and abundance. Mossier (1993) found the diversity of prevalent species generally demonstrated a twofold increase from eutrophic to mesotrophic to oligotrophic lakes. According to the river continuum concept, macrophytes become more abundant in intermediate to large rivers (Vannote et al.1980). This theory is typically supported in lowland rivers where lower gradient and finer sediment produce suitable conditions to cultivate macrophyte establishment and growth. Some natural systems have unacceptable conditions for macrophyte establishment due to depth (decreased light penetration), turbidity, swift current, unstable substrate, and lake and reservoir water level fluctuations. Depending on the ecology of the system, macrophytes may typically provide food (in the form of detritus) and shelter. In ecologically unstable conditions, however, macrophytes may produce dense mats which are aesthetically objectionable (Coots and Carey 1991; Allen 1995) and reduce fish yield (Coots and Carey 1991).

Fecal Coliform and *E. coli* Bacteria

Although fecal coliform is not a pathogen, its quantification has been used as a surrogate for measuring pathogens in the water column. Through numerical fecal-coliform criteria, the state of Idaho has set water-quality standards to protect primary- and secondary-contact recreation beneficial use (IDAPA 16.01.2100, .03, .06, .07).

DEQ is presently drafting changes to the water-quality standards to adopt *E. coli* as the indicator organism for human and animal fecal sources. Some studies have shown that *Escherichia coli (E. coli*), a bacteria of the fecal coliform group, had the best correlation with gastroenteritis rates at both freshwater and marine bathing beaches (EPA 1992). EPA adopted *E. coli* and enterococci as revised indicator bacteria in 1986 (Ambient Water Quality Criteria for Bacteria 1986). In anticipation of this potential change, DEQ will analyze collected samples for both fecal coliform and *E. coli*.

VI. Criteria to Use River Protocol

The field season will occur from August through October, when most rivers are at base flow, to facilitate sampling efforts and limit safety problems. Some rivers may be wadable at this time, but still require the river protocol. To determine if the river protocol is appropriate for a water body, the following questions should be asked prior to initiating field work:

1. Is the entire sampling reach safely wadable?

2. Can the entire protocol for wadable streams be performed?

If the answer is "no" to either question, then the river protocol should be used.

VII. Existing Data Review

Review of other data is important. Such a review serves two purposes: eliminates collection of similar data that has been recently measured and provides a benchmark from which to evaluate temporal trends. This cost-effective step should be performed for each water body. As part of the "pre-planning" process, the regional office contact should check for available data at sources such as:

- Idaho Department of Fish and Game
- Idaho Division of Health (Health Districts)
- Idaho Department of Water Resources
- Idaho Division of Environmental Quality (internal sources)
- Bureau of Land Management
- Bureau of Reclamation
- Natural Resource Conservation Service
- Tribal Nations
- Universities
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- U.S. Geological Survey
- EDMS (IDWR)
- STORET (EPA)
- Internet searches (if access available)
- GIS coverages from DEQ and other agencies
- Hydropower companies
- Other appropriate resources

Each BURP site must have fish, fecal coliform and *E. coli* data that is less than five years old. A search for this data is required.

VIII. River Selection

The following priorities are recommended to address current BURP and agency goals:

1. water quality limited stream [per Idaho 1996 §303 (d) list] (DEQ 1997);

2. large rivers located in a sub-basin assessment; and

3. large rivers that may provide reference conditions.

IX. Sampling Reach and Site Selection

Sampling locations must be chosen carefully to obtain representative data for beneficial use status determinations. The first step is to select a sampling reach. A sampling reach is defined as the selected section of the river where monitoring is conducted. The sampling reach should represent factors that influence physical, chemical, and biological properties of the river water quality. The sampling reach should include at least two examples each of two different types of geomorphic channel units to ensure erosional and depositional areas are represented (i.e., 2 riffles + 2 pools, 2 runs + 2 glides, etc.). Geomorphic channel units, such as pools, riffles, and runs, describe channel shape and scour patterns (Meador et al. 1993). At least one sampling reach should be located on each § 303(d) listed segment. All segments should include a sufficient number of reaches to fully characterize the condition of the river.

Many large river sampling reaches may only have one habitat type, such as a run. When this occurs, the length of the sampling site should be 20 times the channel width or 500 m, whichever is greater. The maximum reach length is 1000 m. The channel width within the reach should be representative of the stream (Robinson and Minshall 1995).

The following are other recommendations to accomplish representative sampling:

- The regional office contact should take preplanning office steps, such as conferring with other resource agency representatives, examining existing data, and investigating maps and aerial photographs, to provide the basis for sampling reach and site selection. Factors that may influence the stream reach such as tributaries and man-made structures or channel alterations should be investigated during this phase (DEQ 1996 a).

- The regional office contact should conduct a reconnaissance of potential sites to determine accessability, boat ramp availability, and sampling equipment requirements (Robinson and Minshall 1995).

- The sampling reach should be located near a USGS gaging station, if possible, to provide information such as discharge data (Robinson and Minshall 1995).

After identifying the sampling reach, select six transects equidistant along the reach. These sites are the locations systematically chosen to represent the entire reach or even a river. Sampling should begin downstream at transect six and work upstream to transect one unless this procedure is too time consuming due to river conditions. Idaho State University worked upstream to downstream in some rivers and found no evidence of this impacting the data (Royer, personal communication, 1997).

X. Core Parameters

Core parameters will be measured consistently statewide to obtain reliable and comparable data. Parameters were selected based on the goal to assess beneficial use support status of waters rapidly and cost-effectively. The following table provides the core parameters, method references, and levels of intensity. Some measures directly evaluate beneficial uses while others are surrogate measures for uses that cannot be directly assessed at a reconnaissance level. A (Q) after the parameter indicates that it is a quantitative measurement, while a (S) signifies a subjective (or qualitative) measurement.

Table 1. Summary Table for River Core Parameters

Note: (M) = modified

Parameter	Method Reference	Level of intensity
Physical and Chemical Measures		
Photo Documentation (S)	Meador et al. 1993 (M)	Photograph upstream, downstream, left bank and right bank at transects 1 and 6. Take photos of atypical conditions. Take a panoramic photo of reach.
Diagrammatic mapping	Meador et al. 1993	Draw a representative map of the reach.
Discharge (Q or S)	Robinson and Minshall 1995 (M)	Collect data from outside sources. If unavailable, then measure at transect 1 in safely wadable conditions. Use historical data, if necessary.
Width, wetted and bank full (Q)	Robinson and Minshall 1995 (M)	Measure widths at transects 1-6.

Parameter	Method Reference	Level of intensity
Bank full height (Q)	Robinson and Minshall 1995	Measure height from water surface to bank full at transects 1-6.
Streambank condition and material types (S)	Meador et al. 1993 (M)	Code bank erosion and spatially dominant substrate types at transects 1-6 for the left and right banks.
Riparian vegetation (S)	Robinson and Minshall 1995, Bahls 1996 (M)	Rate riparian vegetation at transects 1 -6 for the left and right banks.
Channel alteration (S)	Meador et al. 1993, EPA 1996 a (M)	Note codes of all types of channel alterations at transects 1-6.
Floodplain disturbance (S)	none	Review aerial photos or GIS coverage of a 10 mile section of river centered on the sampling reach. To ground truth, perform field observations of land use in the floodplain area.
Geomorphic channel units (S)	Robinson and Minshall 1995 (M)	Estimate length of types throughout sampling reach and calculate approximate percentage for reach of each listed type.
Water depth (Q)	Robinson and Minshall 1995 (M)	Measure at 20 equidistant locations along the three transects where macroinvertebrates are collected.
Substrate size (S)	Robinson and Minshall 1995; Meador et al. 1993 (M)	Note substrate type at 20 equidistant locations along the three transects where macroinvertebrates are collected.
Embeddedness (S)	Robinson and Minshall 1995 (M)	Note the percent category of bottom covered or surrounded by fine sediment at the locations where macroinvertebrates are collected.
Gradient (S)	none	Determine gradient of sampling reach and 10-mile section using topographical map (1:100,000).

Parameter	Method Reference	Level of intensity
Water clarity (S)	Robinson and Minshall 1995 (M)	Note category of clarity at transect 1.
Water temperature, Specific conductance, pH, Dissolved oxygen (Q)		Measure parameters at transect 1 using a Hydrolab©.
Biological		
Fish	To be determined	Use existing data collected by other sources (IDFG, USFWS, etc.). If no fish data for the river exists, DEQ will coordinate with IDFG to collect fish community data.
Macroinvertebrates (Q)	Robinson and Minshall 1995, Meador et al. 1993 (M)	Collect three samples using Slack sampler, with 425 μm mesh at three riffle transects or transects 1, 3, 6 if uniform habitat conditions; samples preserved and stored separately in the field; laboratory personnel composite the three samples, count and identify first 500 individuals; Petite Ponar used if conditions do not permit use of Slack sampler.
Periphyton (Q)	Porter et al 1993 (M)	Collect three samples using syringe sampler and periphyton brushes at three riffle transects or transects 1, 3, 6 if uniform habitat conditions; samples composited per transect, preserved and stored in the field; laboratory personnel count and identify a minimum of 300 individuals.
Aquatic macrophyte cover (S)	Robinson and Minshall 1995 (M)	Note abundance and location of macrophytes.
Fecal coliform and *E. coli* count (Q)	Standard Methods 9060 A., 9222 D., 9211 D. (Franson 1995)	Use existing data if collected within 5 years. If unavailable, then collect 1 sample during the recreational season (May through September).

XI. Description of Method Modifications

Photo Documentation and Diagrammatic Mapping

Photograph stream conditions at transects 1 and 6 using slide film and date back cameras. Take four photographs at transects 1 and 6 of upstream, downstream, left bank and right bank locations. At the remaining transects, take photos of atypical conditions that influence qualitative calls such as unstable banks, bank erosion, channel alterations and riparian changes. Record the azimuth of the camera lens using a compass. Use dry erase boards in the photograph to provide a scale of reference, pertinent location information, and facilitation of repeat photographs (DEQ 1996 a, Meador et al. 1993).

Discharge and Gradient

Determine gradient of the sampling reach and a 10-mile section (5 miles above and below the site) using topographical maps (1:100,000).

It's often too time consuming to measure discharge in rivers, particularly in nonwadable reaches. Consequently, review existing USGS data collected near the sampling reach to obtain discharge data. If there is no current discharge data and it's too time consuming to measure discharge, then use historical data.

To measure discharge in safely wadable conditions, locate a straight, non-braided stretch of your sampling reach. Place a measuring tape across the river perpendicular to the flow. Take evenly spaced velocity measurements from wetted bank to wetted bank so that no more than 5% of the total discharge is in each (partial cross-section). Record the horizontal distance measured from the tape and record depth and velocity from the top-setting wading rod and electromagnetic velocity meter. For depths ≥2.5 feet, two velocity measurements are taken for each partial cross-section; one at 20% of total depth and a second at 80% of total depth (Harrelson et al 1994).

Width and Depth

Measure wetted stream width, bank full width, and bank full height using a modification of the ISU protocol. For nonwadable rivers, use the laser rangefinder to measure wetted and bank full widths. For wadable rivers perform the following measurements:

- Stretch, secure, and level tape across bank full width.
- Measure and record bank full width.
- Measure and record the vertical distance from the tape at bank full elevation to the wetted edge.
- Measure and record wetted width.

Perform water depth measurements along the three transects where macroinvertebrates are collected. In wadable conditions, measure depth at 20 equidistant locations along the transect using a 2m rod. In nonwadable reaches, use a depth finder and time 20 intervals across the transect.

When a width/depth transect is measured in a split channel, there are two ways to perform the measurement. Bank full measurements should be taken in the channel with the most discharge if the area between the channels is above the ordinary high water level. Bank full measurements should be taken across both of the channels if the area between the channels is below the ordinary high water level.

Substrate and Embeddedness

Estimate substrate size, using measurement gage, at 20 equidistant locations along the three transects where macroinvertebrates are collected. Record appropriately for the substrate size category (Chapman and McLeod 1987). In turbid, wadable reaches, determine substrate size by touch. In nonwadable reaches, use a substrate probe (metal, hollow rod in 10 ft. sections) to evaluate substrate size (Robinson and Minshall 1995).

For embeddedness, use a view scope to ocularly estimate the percent category of bottom covered or surrounded by fine sediment at the locations where macroinvertebrates are collected. Record percentage category on field form. If the measurement can't be made, then record "no measurement" on the field form.

Bank Erosion

Determine type of bank erosion from the water edge to bank full using appropriate coding system. Perform the qualitative measurement within 4m of each transect and record according to the categories developed for the NAWQA stream habitat protocol (Meador et al. 1993). If no bank erosion is evident, then record "NA".

For bank material types, identify the spatially dominant bank materials within 4 m of each transect to the top of the bank (normal high water line). Use substrate size categories developed for the NAWQA stream habitat protocol to categorize these materials (Meador et al. 1993).

Channel Alterations

Identify various water management features above the site (1 mile), at the site, and below the site (1 mile) for the left and right banks. Record features according to the coding system developed in the NAWQA stream habitat protocol (Meador et al.1993). The DEQ may provide codes as appropriate to identify additional channel alteration features.

Floodplain Disturbance
Use aerial photos, if available, or GIS coverages to estimate the percentage of the natural floodplain that is disturbed by land use activities such as roads or agricultural fields. Observe and record floodplain disturbance in the field to ground truth interpretations of the land use coverages. Observe the floodplain that is visible, and note uncultivated and naturally occurring riparian vegetation such as trees, shrubs, and grassy meadows.

Riparian Vegetation
To assess the condition of the riparian vegetation, ocularly estimate the predominant vegetation, identify recognizable species, evaluate the riparian zone condition, and note the extensiveness of the zone according to qualitative questions asked on the field form (Bahls 1996). Record appropriate codes for the left and right bank at transects 1-6.

Habitat Types
Estimate the length (m) of each habitat type (riffle, run, glide, and pool) along each transect range. Calculate an approximate percentage of each habitat type for the entire sampling reach using the estimated lengths (Robinson and Minshall 1995).

Physical and Chemical Parameters Within the Water Column
Use a Hydrolab© to measure temperature, pH, dissolved oxygen, specific conductance, and total dissolved solids at transect 1. For calibrations, follow procedures outlined in the *H2O® Water Quality Multiprobe Operation Manual* and calibrate weekly (HYDROLAB Corporation 1995).

Macroinvertebrates
Collect three samples at three riffle transects or transects 1, 3, and 6 if uniform habitat conditions exist. Composite samples per transect, preserve, and store separately in the field. Laboratory personnel will composite the three samples, count, and identify the first 500 individuals (Robinson and Minshall 1995).

Fish
Thoroughly review existing fish information for the specified rivers prior to collecting additional data. The regional offices will contact the Idaho Department of Fish and Game (IDFG) to acquire all fisheries data on the specified rivers. If the existing data is greater than five years old, the regional offices will coordinate with the IDFG regional offices to determine sampling needs. The DEQ and IDFG should collaborate to determine protocols for additional data collection prior to sampling activities.

Periphyton

Collect periphyton samples according to the NAWQA algae protocol (Porter et al. 1993). Collect three samples of periphyton at three riffle transects or transects 1, 3, and 6 if uniform habitat conditions exist. Composite samples per transect, preserve, and store in the field. Laboratory personnel will count and identify a minimum of 300 individuals.

Aquatic Macrophyte Cover

Note abundance and location of aquatic macrophyte cover.

Fecal Coliform and *E. coli*

The regional office contact will collect one sample during the recreation season (May through September). Perform sampling according to Standard Methods (APHA 1992, 9060 A, 9211 D.). Collect samples as close to the main stream (thalweg) as possible by wading, boating, or using a sampling device from a bridge. Avoid sampling from banks and in slack water. If sampling is performed from a bridge, take the sample from the upstream side (Ralston and Browne 1976).

Collect samples in a sterile (auto-claved) 250 ml Nagelene™ bottle with prior treatment of Sodium Thiosulfate ($NA_2S_2O_3$). Dip the bottle into the flowing water allowing for a 1/4 inch air gap between the waterline and neck of the bottle. Do not rinse the bottle before sampling and do not remove the cap until sampling.

XII. Quality Assurance and Quality Control

Quality Assurance

Collection of reliable and accurate monitoring and measurement data is the goal of the quality assurance (QA) program in the BURP process. The three aspects of the DEQ river BURP quality assurance program aimed at enhancing reliability, accuracy, and consistency are: 1) crew supervision; 2) crew and regional contact(s) training; and 3) field reviews.

Crew Supervision

One crew performs the river monitoring statewide. This arrangement requires fewer resources (e.g., equipment, personnel, etc.), increases efficiency, and reduces sampling inconsistencies. The DEQ central office supervises the state crew throughout the data collection season. A minimum of one regional office contact accompanies the crew while it is in that region. The regional office contact(s) also participate in training activities.

Training

Training for central office contacts, regional office contacts, and crew members will be conducted. Crew members will be trained earlier and separately from central and regional office contacts. Crew training will include training materials, method instruction, field instruction, and safety instruction. A field observation training will be available for central and regional office staff.

Field Audits

DEQ designated contacts will observe the state crew measure, collect and preserve field data. These audits will be conducted periodically throughout the field season to ensure data collected is consistent and reliable for assessment of beneficial uses. The DEQ contacts will provide feedback to the crew and additional training, if necessary.

Equipment Maintenance and Calibration

Field

All sampling equipment (e.g. bottles, nets) and other items that have come in contact with a sample and have the potential to contaminate other measures must be carefully examined and cleaned of any material after sampling is completed at any site. All equipment should be examined again prior to use at the next site and recleaned if needed.

Laboratory

The Hydrolab© or other similar multi-measure probes must be calibrated before leaving the field following recommend procedures (Hydrolab Corporation 1995). Calibration standards and procedures will be recorded in a log.

Some measures are to be completed by parties other than the DEQ. Maintenance and calibration will be regularly performed as recommended in operations manuals and as part of contractual requirements.

Sample Duplicates and Blanks

The regional office contact will perform the fecal coliform and E. coli duplicates and blanks in concert with their sample collection. Similar to the wadable streams protocol, a blank sample container accompanies the empty sample container into the field. The blank is opened for a few seconds and is stored and transported similarly to the other samples.

The samples are placed on ice and cooled to approximately 4°C for transportation. If necessary, samples are stored in a "sample storage refrigerator" at the nearest DEQ regional office. All samples are submitted to the designated laboratory within 24 hours of collection.

Data Handling and Storage

Proper labeling and field documentation are conducted to demonstrate compliance with sampling protocol and to reduce misidentification of samples. A chain of custody is given to the receiving laboratory to assure proper sample transfer.

The DEQ Watershed Monitoring and Analysis Bureau staff will annually review field forms for completeness, accuracy, and consistency. Sample processing outside of the DEQ will be addressed in appropriate "request for proposals" and subsequent contracts.

Voucher specimens of all organisms collected are stored in glass vials of 70% ETOH (Clark and Gregg 1986) with proper locality, date, collector, and determination labels. These specimens are then available for any later verification that might be needed and for future research opportunities. The specimens are deposited in the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell.

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Glossary

abiotic- applied to the non-living, physical, and chemical components of an ecosystem, as distinct from the biotic or living components.

attainable use- a beneficial use that, with improvement, a waterbody could support in the future.

beneficial use- any of the various uses that may be made of water, including, but not limited to, water supply (agricultural, domestic, or industrial), recreation in or on the water, aquatic biota, wildlife habitat, and aesthetics.

criteria - either a narrative or numerical statement of water quality on which to base judgement of suitability for beneficial use.

designated use - a beneficial use listed for a waterbody or waterbodies in a state's water quality regulations.

discharge - commonly referred to as flow, expressed as volume of fluid per unit time (e.g. cubic feet per second) passing a particular point, in a river or channel or from a pipe.

existing use - a beneficial use actually attained by a waterbody on or after November 28, 1975.

integrity - the extent to which all parts or elements of a system (e.g. aquatic ecosystem) are present and functioning.

monitoring - to check or measure water quality (chemical, physical, or biological) for a specific purpose, such as attainment of beneficial uses.

nonpoint source - referring to pollution originating over a wide geographical area, not discharged from one specific location.

point source - any discernable, confined, or discrete conveyance of pollutant, such as a pipe, ditch, or conduit.

pollution - any alteration in the character or quality of the environment due to human activity that makes it unfit or less suited for beneficial uses.

reconnaissance - an exploratory or preliminary survey of an area.

reference conditions - conditions which fully support applicable beneficial uses, with little impact from human activity and representing the highest level of support attainable.

surface water - the collection of all natural bodies of water, including but not limited to streams, lakes, and wetlands, evident on the surface of the land.

waterbody - a specific body of water or geographically delimited portion thereof.

water quality -a term for the combined chemical, physical, and biological characteristics of water which affect its suitability for beneficial use.

wastewater - treated or untreated sewage, industrial waste, or agricultural waste and associated solids.

thalweg - a line joining the deepest points along successive cross-sections of a river channel.

Appendices

Appendix A. Formalin Health and Safety
Appendix B. Large River Site Selection Reconnaissance Form
Appendix C. 1998 River BURP Field Equipment Checklist
Appendix D. 1998 Field Form

Appendix A. Formalin Health and Safety

All field and laboratory activities will be performed in accordance with the Occupational Safety and Health Administrations requirements for a safe work place. It is the responsibility of the participants to establish and implement the appropriate health and safety procedures for the work being performed. All field staff are expected to review and understand the Material Safety Data Sheet and the Chemical Fact Sheet for chemicals of concern provided by field staff supervisors. Field staff are instructed to immediately report to their supervisor the development of any adverse signs or symptoms that they suspect are attributable to chemical exposure.

The environmental samples scheduled to be collected during this project will be obtained from surface water bodies located in natural settings. Samples to be collected include fish specimens and aquatic macroinvertebrates. The sample stations and samples to be collected are not considered to be hazardous; however, sample preservation materials include formalin (formaldehyde) which requires prudent safety precautions by those collecting samples and those coming into contact with, or disposing of, samples collected during this project.

Hazardous Materials (Formaldehyde)
Commercial grade formalin contains 37 to 55 percent formaldehyde. The use of formaldehyde and its derivatives are regulated under 29 CFR 1910.1048. Formaldehyde is a suspected human carcinogen. Formaldehyde is highly flammable and is incompatible with strong oxidizers, strong alkalies, acids, phenols, and urea.

Formaldehyde Exposure Limits
There may be no safe level of exposure to a carcinogen so all contact with formalin should be reduced to the lowest possible level. The odor threshold of 0.83 parts per million (ppm) for formaldehyde serves only as a warning of exposure. The permissible exposure limit (PEL) for formaldehyde is 0.75 ppm averaged over an eight hour work shift. The time-weighted average (TWA) for airborne concentrations of formaldehyde (STEL) is 2 ppm. The American Conference of Governmental Industrial Hygienist recommend airborne exposure limit to formaldehyde is not to exceed 0.3 ppm averaged over an eight hour work period.

Respirators shall be used when 1) installing feasible engineering and work practice controls, 2) engineering and work practice controls are not feasible, and 3) engineering and work practice controls are not sufficient to reduce exposure to or below the Permissible Exposure Limit. Respirator use should be limited to an MSHA/NIOSH approved supplied air respirator with a full face piece operated in the positive mode or with a full face piece, hood, or helmet operated in the continuous flow mode. An MSHA/NIOSH approved self contained breathing apparatus with a full face piece operated in pressure demand or other positive mode is also recommended.

Formaldehyde exposure occurs through inhalation and absorption. Exposure irritates the eyes, nose, and throat and can cause skin and lung allergies. Higher levels can cause throat spasms and a build up of fluid in the lungs, cause for a medical emergency. Contact can cause severe eye and skin burns, leading to permanent damage. These may appear hours after exposure, even if no pain is felt.

Formaldehyde First Aid

If formaldehyde gets into the eyes, remove any contact lenses at once and irrigate immediately with deionized water, distilled water, or saline solution. If formaldehyde contacts exposed skin, flush with water promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration if needed. When formaldehyde has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Formaldehyde Fire and Explosion Hazard

Mixtures of air and free formaldehyde gas are highly flammable. Formalin is a combustible liquid, and presents a moderate fire and explosion hazard. Use a dry chemical, carbon dioxide, water spray, or "alcohol" form to extinguish formalin fires. Store formalin solutions in insulated, closed containers in a cool, dry, well ventilated area separate from oxidizing agents and alkaline materials. Protect formalin containers from physical damage.

Formalin Spill Procedures

In case of a spill or leak, eliminate all sources of ignition, provide adequate ventilation, notify supervisor, and evacuate all nonessential personnel. Neutralize spilled formalin with aqueous ammonia or mix with sodium sulfite. Wash residues with diluted ammonia to eliminate vapor. Prevent runoff from entering streams, surface waters, waterways, watersheds, and sewers.

Formalin Work Area Controls

Work area locations at stream sampling stations will be selected to ensure adequate ventilation when sample container lids are removed. Work area locations will be located downwind from field crew activities and will be isolated from field crew traffic. A single field crew member will be designated and authorized to secure the formaldehyde work area at sampling stations. This crew member will ensure proper handling of sample containers and fish specimens and will be responsible for establishing proper precautions for minimizing field crew exposure to formaldehyde at sampling stations.

Formalin Work Area Practices

Formalin (formaldehyde) is being used in this protocol for the purpose of asphyxiation and preservation of fish specimens. Pre-labeled and pre-preserved plastic sample containers will be delivered to the field crew secured in large ice chests. Field crews will transport the containers in the coolers to the field sample stations. Fish specimens will be collected by hand and placed into the sample containers. Container lids will be removed immediately prior to and closed immediately after fish specimens and specimen labels are placed into the sample container. Specimens will be placed into the sample container and minimize the amount of time the sample preservative is not contained. The sample container will be placed into a large plastic bag and secured in an ice cooler until delivered to the laboratory for analysis.

Formalin Personal Protection

Field crew members within the designated formalin work area at sample stations will wear a full face shield, impervious nitrile, butyl rubber or viton gloves, boots, and aprons, etc. to prevent excessive or prolonged skin contact. Contact lenses will not be worn within the designated formalin work area. No eating, drinking, or smoking will be allowed in the designated formalin work area.

Wash thoroughly after using formalin. Avoid transferring formalin from hands to mouth while eating, drinking, or smoking. Avoid direct contact with formalin. Remove contaminated clothing and launder before wearing. Contaminated work clothing should not be taken home. Contaminated work clothing should be laundered by individuals who have been informed of the hazards of exposure to formalin.

Appendix B. River BURP Site Selection Reconnaissance Form

Water Body Name: ______________________ Date: __ - __ - __ (YY/MM/DD)

Water Body Boundaries: ______________________

Water Body Length (approx): __________ Investigator: ______________________

Suggested Site Relative to Landmark: ______________________

____

Legal Description or ______________________

Time/Mileage to Site ______________________ Photograph of Location (optional): __________

USGS Gaging Station: ❑ Station #: __________ Location/Discharge Info: ______________________

____

Accessability: ______________________

Boat (check all that apply): Jet ❑ Prop ❑ Raft (sm) ❑ Raft (lg) ❑ Jon ❑ Wadable (in most areas) ❑

Comments: ______________________

Boat Ramp Locations (if necessary): ______________________

____

Recommendation for Macroinvertebrate Sampler: Slack ❑ Ponar ❑ Other ❑ __________

Comments: ______________________

General Notes: ______________________

____

Nearby Camping Facilities: ______________________

____

Fecal Coliform and Ecoli Sample (fill out field form) ❑ Other Data ❑: ______________________

Rationale for Site Selection: Representative ❑ Accessible ❑ Gaging Station ❑ Other ❑ __________

____

Explanation of Form

Water Body Name: Rive name

Date: Calendar date as year-month-day

Water Body Boundaries: River boundaries represented by the site. Use boundaries as shown on the 303d list if representing the entire 303d segment.

Water Body Length (approx): Length of the river segment represented by the site.

Investigator: Name of the person performing the site selection reconnaissance.

Suggested Site Relative to Landmark: Descriptive information of where the site is located relative to a permanent, easily recognized landmark.

Legal Description or Map: List legal description or identify location on map.

Time/Mileage to Site: Estimate time and mileage to site from a known location such as the DEQ Regional Office.

Photograph of Location: Optional. Photograph location to provide crew visual information about the site.

USGS Gaging Station, Station #, Location/Discharge Info: Check box if using data from a nearby gaging station and provide station number. Describe location of the station using easily recognized landmarks. Note if using other discharge information.

Accessability: List condition of roads, trails, or landing strips used for access. Indicate any private property concerns.

Boat/Comments: Check all boat types that could be used for sampling on the river. If the reach is wadable in most areas during base flow, then check the appropriate box. Describe any special considerations such as boating restrictions, large boulders, etc.

Boat Ramp Locations: Recommend boat launching locations if appropriate.

Recommendation for Macroinvertebrate Sampler/Comments: Indicate equipment that will be needed for sampling. Describe substrate size and other factors that should be considered when sampling.

General Notes: List factors which may influence sampling and results. Examples include man-made structures, channel alterations, land use, and riparian condition. List any additional recommendations such as safety considerations.

Nearby Camping Facilities: List facilities and locations.

Fecal Coliform and E. coli Sample/Other Data: Check box if sample collected and fill out appropriate information on field form. Indicate if using other data to fulfill fecal coliform and *E. coli* information requirements.

Rationale for site selection: Check appropriate boxes indicating why this site was recommended. Describe further if necessary.

Appendix C. 1998 River BURP Field Equipment Checklist

Parameter	Equipment	Qty.	Yes	No
Discharge (wadable sites with no gage info)	Flow meter	1		
	Top-setting wading rod	1		
Wetted stream width Bankfull width Bankfull height Water depth	65 m tape measure	1		
	Rangefinder/carrying case	1		
	2 m rod	1		
	Extendable surveyor's rod	1		
	Levels (2)	2		
	Surveyor's rope	1		
	Hand sledge hammer	1		
	Clamp	1		
	Rebar	6 - 18" pieces		
	Flagging	1 roll		
Substrate size/ Embeddedness	Substrate probe (nonwadable)	1		
	View box	1		
Water temperature Conductivity pH Dissolved oxygen	Hydrolab Scout	1		
Macroinvertebrates	Slack Sampler	1		
	Dolphin bucket	1		
	Dolphin bucket net adapter	1		
	Aluminum area delineator	1		

Parameter	Equipment	Qty.	Yes	No
	Slack bag replacement	1		
	Extra nuts and bolts for delineator	4		
	Rebar (5 ft sections)	2		
	White pans	2		
	Sample containers	6 per site min.		
	Preservative (70% ethanol)			
	Scrub brush	1		
	Squirt bottles	1 large 2 medium		
	Trapper gloves	1		
	Forceps	1		
	Indelible alcohol proof markers			
	Waders, boots, belts, neoprene gloves and aquaseal (1 extra set of waders)	2 sets		
	Sieve Bucket 500μ (nonwadable)	1		
	Petite Ponar (nonwadable)	1		
Periphyton (red org. box)	Syringe Samplers	2 1-layer 1 2-layer		
	Periphyton brushes	4		
	Algae droppers	2		
	Sample containers	3 per site		
	Formalin dropper	2		
	Formalin (2%)	1 bottle		
	Pencil, sharpies, extra sample cards			
Raft	Raft, patch kit	1		
	Foam (for raft floor)	1		

Parameter	Equipment	Qty.	Yes	No
	Rope	1		
	Hand pump	1		
	Paddles	2		
	Life jackets	2		
Boat (nonwadable conditions)	Jet, prop, other			
Truck	Tool kit	1		
	First aid kit	1		
	Idaho atlas	1		
	Vehicle book			
	Cell phone	1		
Blue box	Extra batteries	4 pkg		
	Duct tape	1		
	Clear tape	1		
	Clipboard	1		
	G.P.S. receiver	1		
	Camera with case	1		
	Film	1 roll / site min		
	Film Development			
	Dry-erase board	1		
	Dry-erase markers	2		
	Compass	1		
	Zip-lock bags			
	Garbage bags			
	Paper towels			

Parameter	Equipment	Qty.	Yes	No
	1 plastic pouch filled with: -pens, pencils, sharpies -alcohol pens			
	Dry bag for clothes	1		
	Calculator			
Black file box	Blank field forms (copied on Rite in Rain paper)	1 set per site		
	Macroinvertebrate sample cards/ hole punch	12 per site min.		
	Periphyton sample cards	3 per site min.		
	Reconnaissance forms from region			
	Maps			
	Itinerary			
	Riparian field key, plant list			
	Large river manual			

Appendix D. Revised River BURP Field Forms

(REVISED 07/28/98, version 4)

Large River 1998 Beneficial Use Reconnaissance Project Field Forms
Idaho Division of Environmental Quality

Site Identification

Stream Name: ______ Site ID: 98______ Date (YY/MM/DD): 98______

Segment Description: From: ______ To: ______

HUC: ______ PNRS: ______ WB ID No.: ______

Public Land Survey: Twnshp ______ Range ______ Section ______ ______ 1/4 of the ______ 1/4 of the ______ 1/4

Latitude: ______ Degrees ______ Minutes ______ . ______ Seconds Longitude: ______ Degrees ______ Minutes ______ . ______ Seconds

Datum: NAD83 ______ NAD27 ______ Other ______ Lat/Long Confidence: 2-5 meters ______ 100 meters (raw) ______ 500 meters (estimate) ______

County: ______ Ecoregion: ______ Map Elevation (ft or m) ______

Location Relative to Landmark: ______

Weather Conditions: ______ Crew Members: ______

Data Collection

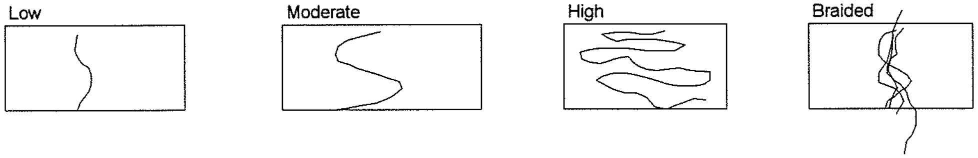
Total Length of Reach Surveyed: ______ m Stream Order: 5 6 7 8 9 (circle one) Stream Gradient: ______ % site

______ % segment

Fish Observed: ______ Amphibians Observed: ______

Sinuosity:
circle one

Low Moderate High Braided



Hydrolab Readings at Transect 1:

Temperature: ______ Time: ______

Dissolved Oxygen: ______

Conductivity: ______

pH: ______

Water Clarity (T1): (circle one) Very Turbid Turbid Slightly Turbid Clear

Principle Activities Affecting Watershed Above Reach: Circle All That Apply:

Forestry Mining Agriculture Roads Recreation Urban Diversion Beaver Complex Grazing Other: ______

Large River 1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: Site ID: 98 Date (YY/MM/DD): 98

MacroInvertebrate Sample (indicate transect sampled)

Transect No. ____
Label: ________
Sampler Used: Slack Petite Ponar Other: ________
Ponar drops (if used) ________
Habitat Sampled: Riffle Run Glide Pool
Time: ________
By: ________
Embeddedness (%)

0	1- 25	26 - 50	56-75	>75

Transect No. ____
Label: ________
Sampler Used: Slack Petite Ponar Other: ________
Ponar drops (if used) ________
Habitat Sampled: Riffle Run Glide Pool
Time: ________
By: ________
Embeddedness (%)

0	1- 25	26 - 50	56-75	>75

Transect No. ____
Label: ________
Sampler Used: Slack Petite Ponar Other: ________
Ponar drops (if used) ________
Habitat Sampled: Riffle Run Glide Pool
Time: ________
By: ________
Embeddedness (%)

0	1- 25	26 - 50	56-75	>75

Periphyton Collection (indicate transect sampled)

Transect No. __ Abundance: Dense Moderate Sparse None
Number Samples Collected and Composited:
Sampler Used: Syringe Other: ________
Sample Area (if syringe not used): ________
Habitat Sampled: Riffle Run Glide Pool
Sample locations per protocol? Yes No (see comments)

Transect No. __ Abundance: Dense Moderate Sparse None
Number Samples Collected and Composited:
Sampler Used: Syringe Other: ________
Sample Area (if syringe not used): ________
Habitat Sampled: Riffle Run Glide Pool
Sample locations per protocol? Yes No (see comments)

Transect No. __ Abundance: Dense Moderate Sparse
Number Samples Collected and Composited: None
Sampler Used: Syringe Other: ________
Sample Area (if syringe not used): ________
Habitat Sampled: Riffle Run Glide Pool
Sample locations per protocol? Yes No (see comments)

Comments: (changes to protocol, flow conditions, turbidity, etc.)

Large River 1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ______________________ Site ID: 98 ______ Date (YY/MM/DD): 98 ______

Bank Erosion and Material:

	T1		T2		T3		T4		T5		T6	
	Left*	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Bank Erosion (code)**												
Bank Material(code)***												

*left/right bank facing upstre ** within transect range *** dominant substrate within 2m of either side of transect - water surface to bankfull

Bank Material and Substrate Size:

BR - Bedrock CO - Cobble SA - Sand HP - Hardpan DE - Detritus

BO - Boulder GV - Gravel SI - Silt MU - Muck AR - Artificial

Bank Stability:

DA - Debris Avalanche CB - Cut-bank Scalloping NO - None

RF - Rotational Failure SL - Slab Failure

Riparian Vegetation*:

	Bank	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
Predominant Veg	Left **						
	Right						
Extensiveness	Left						
	Right						
Condition	Left						
	Right						

*see code sheet ** facing upstream

Community species in descending order of dominance:

____
____
____
____
____
____
____
____
____
____

Principle source of riparian disturbance Circle All That Apply:

Forestry Mining Agriculture Roads Recreation Urban Diversion Beaver Complex Grazing Other: ______________

Comments on riparian status:

Large River 1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ____________________ Site ID: 98 ____________ Date (YY/MM/DD): 98 ________

Habitat Distribution

	Riffle (m)	Run (m)	Pool (m)	Glide (m)
Transect 1 -> Transect 2				
Transect 2 -> Transect 3				
Transect 3 -> Transect 4				
Transect 4 -> Transect 5				
Transect 5 -> Transect 6				
Length (m)				
Percentage				

Width/Bank Height:

	T1	T2	T3	T4	T5	T6
Wetted Width(m)						
Bankfull Width(m)						
Bankfull Height(m)						

** water surface to bankfull

Channel Alteration/Bank Modification (describe in detail in comments section)

	Left*	Right*	Left*	Right*	Left*	Right*	Left*	Right*	Left*	Right*
Above site										
Site										
Below site										

*left/right bank facing upstream

Codes:

BR - Bridge	HP - Hydropower	TD - Thermal discharge	OT - Other
CA - Channelized Area	IM - Impoundment	WT - Wastewater treatment	FL - Feedlot
DV - Diversion	IO - Industrial Outflow	SS - Storm sewer	
NL - Natural lake	LH - Lowhead dam	SB - Streambank stabilization	

Photo Information

Roll Name (Number): ____________

Photo # ______ Azimuth ______ Caption ____________
Photo # ______ Azimuth ______ Caption ____________
Photo # ______ Azimuth ______ Caption ____________
Photo # ______ Azimuth ______ Caption ____________
Photo # ______ Azimuth ______ Caption ____________
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Photo # ______ Azimuth ______ Caption ____________
Photo # ______ Azimuth ______ Caption ____________
Photo # ______ Azimuth ______ Caption ____________
Photo # Azimuth Caption

Channel alteration comments:

Large River 1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ______________________ Site ID: 98__________ Date (YY/MM/DD): 98______

Transect No. (indicate on form)

Wetted Depth (m)

	1				5					10					15					20
No.																				
No.																				
No.																				

Substrate Size*

Transect No. (indicate on form)

	T No.	T No.	T No.	Total	%
Fines 0 - 6mm					
Subtotal					
Pebble/Gravel 6.1 - 64mm					
Cobble 64.1 - 256mm					
Boulder 256.1mm<					
Bedrock Solid rock forming a continuous surface					
Artificial (e.g. rock baskets, concrete)					
Total					

* at same location as depth measurements

Large River 1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ______________________ Site ID: 98 ____________ Date (YY/MM/DD): 98 ________

Discharge Measurement (if needed)

	Tape	Width	Depth	Area	Velocity	Velocity	Discharge
	ft	ft	ft	sq ft	ft/sec	ft/sec	cfs
LWE							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
RWE							

Discharge (if known) - USGS Other Measured ______ cfs

Comments:

Percent of Natural Floodplain Available ______ %

Comments:

Fecal Coliform and E. coli Results

Label: ______________________

Location Taken: ______________________

Time/Date Taken: ______________________

Taken By: ______________________

Fecal Coliform
Total Count per 100ml): ______ #/100ml

E. coli
Total Count per 100ml): ______ #/100ml

Current Activities Immediately Above Reach Which Might Affect Results:

Large River 1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ______________________ Site ID: 98 ______________ Date (YY/MM/DD): 98 ________

Notes: **Floodplain Availability:**
Transect 1:
Transect 2:
Transect 3:
Transect 4:
Transect 5:
Transect 6:

Large River 1998 Beneficial Use Reconnaissance Project Field Forms

Stream Name: ______________________ Site ID: 98______ Date (YY/MM/DD): 98______

Detailed Drawing of Entire Reach